Reducing the Fog of War: Linking Tactical War Gaming to Critical Thinking

A Monograph
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ABSTRACT

REDUCING THE FOG OF WAR: LINKING TACTICAL WAR GAMING TO CRITICAL THINKING by MAJ Samuel E. Whitehurst, USA, 51 pages.

Based upon observations from the Combat Training Centers, military staffs are ineffective at tactical war gaming and thus the war game rarely contributes to effective decision-making. While war gaming is generally recognized as a weakness among many military staffs, many have concluded that the problems with the tactical war game reside in the participants lack of training or not understanding planning doctrine. This monograph does not accept this conclusion and explores, instead, the system itself. The purpose of this monograph is to find flaws not only in the 8-Step War Game Model but in the MDMP itself that contribute to ineffective war gaming. Additionally, this monograph recommends changes to the MDMP and war gaming that will make it a better tool that takes advantages of how expert decision makers think and plan.

This monograph establishes that the war game and to a certain extent, the MDMP, are ineffective because their focus reflects a linear approach to decision making that attempts to remove uncertainty from planning by developing multiple courses of actions (COAs), and then selecting the best COA based upon established criteria. The opposite to a linear approach to decision making, is a non-linear approach that accepts battlefield uncertainty as a constant and focuses on managing uncertainty, rather than eliminating it. This monograph then argues that the true power of war gaming comes from its potential as a non-linear decision making tool. Next, this monograph demonstrates that the tactical war game never realizes its potential because of the tension that is created from trying to war game multiple COAs. Additionally, this linear approach is counterproductive to group decision-making because it encourages groupthink, a common pitfall of group decision-making.

In order to explore alternatives or modifications to the MDMP or the 8-Step War Game Model, this monograph examines the qualities that define expert decision-making as well as the strengths and weaknesses of a non-linear decision-making methodology, naturalistic decision-making theory. The goal will be to develop a process that aims at tapping into the qualities that define expert decision-making by taking advantage of the natural cognitive process that underlies planning and decision-making.

This monograph concludes by introducing a naturalistic decision-making theory, Recognition/Metacognition Theory, as a framework to make changes to the MDMP and the 8-Step War Game Model to encourage critical thinking and make not only war gaming, but the entire MDMP more effective at managing battlefield uncertainty.

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CHAPTER ONE

INTRODUCTION

PROBLEM

Units have struggled with war-gaming as a training issue for the past 10 years.[1]

A critical aspect of the Military Decision Making Process (MDMP) is the 8-step War Game Model. According to doctrine, it not only reveals the strengths and weaknesses of COAs by mentally simulating the future battle against an uncooperative enemy, but it also facilitates the development of shared visualization between the commander and staff, identifies critical decisions that both the friendly and enemy commander will make in the impending fight, and incorporates flexibility through the development of branches and sequels. Findings from the combat training centers, however, demonstrate that there is a wide gulf between the theoretical and doctrinal goals of tactical war gaming and the reality of practical application.[2] From these observations, it would appear that the problems with the war-gaming process are the result of staff training deficiencies or a lack of staff experience. Consequently, many writers have concluded that the problems with the war-gaming process are due to flawed

[1] Center for Army Lessons Learned, *NATIONAL TRAINING CENTER TRENDS COMPENDIUM 3QFY97 through 2QFY98*, Internet, http://call.army.mil/products/ctc_bull/99-1/99-1toc.htm, accessed 15 October 2001.

[2] The following are observer/controller observations from NTC and JRTC, available from http://call.army.mil/homepage/ctcbull.htm; Internet; accessed 15 October 2001.

- Commanders and staffs' training at the JRTC do not demonstrate a suitable level of understanding or proficiency with synchronization. (*CTC Quarterly Bulletin, March 00, 4QFY99*)
- War gaming is weak within too many maneuver task forces. (*NTC Trends and TTPs, 3&4QFY98*)
- Staffs consume so much time that the war game is either incomplete or only addresses one course of action and does not include any branches or sequels. (*NTC Trends and TTPs, 3&4QFY99*)
- The plan has little or no flexibility and is often based on one enemy COA (*NTC Trends and TTPs, 3&4QFY99)*
- War gaming continues to be the most difficult step in the military decision making process for units to complete successfully (*NTC Trends Compendium, No. 99-1*)

understanding or flawed execution.[3] This monograph demonstrates that the process itself is flawed as a planning tool, not the user.

BACKGROUND

In terms of decision-making, uncertainty is "what we do not know or understand about a given situation . . . doubt that threatens to block action."[4] Metaphorically, uncertainty is the "fog of war" that guarantees that the commander will never have 100% situational understanding.[5] Accepting and managing uncertainty is often the difference between success and failure. Successful commanders learn to recognize when uncertainty necessitates a change in the plan, and how to structure the battlefield and anticipate enemy events based on limited information in order to reduce uncertainty.[6] Central to any discussion about managing uncertainty is the tactical war game. War gaming, which is embedded in the third step of the Military Decision-Making Process (MDMP), COA Analysis, has the dual role of identifying strengths and weaknesses of COAs and assisting the commander in managing uncertainty through the creation and/or refinement of CCIR, the event template, the DST, and contingency plans. It is this cognitive tension between being a tool for comparing COAs and a tool to manage uncertainty that often prevents staffs from fully realizing the potential of the tactical war game. This tension is not only isolated to the war game, but is also evident in the MDMP as a whole. Understanding the problems with the tactical war game begins with

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[3] Walter E. Kretchik, *The Manual War-gaming Process: Does our Current Methodology Give Us The Optimum Solution?* (SAMS Monograph, U.S. Army Command and General Staff College, 1992), 40; John J. Marr, *The Military Decision Making Process: Making Better Decisions Versus Making Decisions Better* (SAMS Monograph, U.S. Army Command and General Staff College, 2001), 58, 66.

[4] John F. Schmitt and Gary Klein, "Fighting in Fog: Dealing with Battlefield Uncertainty," *Marine Corps Gazette* (August 1996): 63.

[5] Carl von Clausewitz, *On War*, Michael E. Howard and Peter Paret, eds. (Princeton, NJ: Princeton University Press, 1976), 101. "War is the realm of uncertainty; three quarters of the factors on which action in war is based are wrapped in a fog of greater or lesser uncertainty."

[6] Schmitt and Klein, "Fighting in Fog: Dealing with Battlefield Uncertainty," 68-69.

understanding the tension between a linear and a non-linear approach to decision-making that resides in the MDMP.

UNCERTAINTY AND WAR

> From Plato to NATO, the history of command in war consists essentially of an endless quest for certainty—certainty about the state and intentions of the enemy's forces; certainty about the manifold factors that together constitute the environment in which the war is fought, from the weather and the terrain to radioactivity and the presence of chemical warfare agents; and, last but definitely not least, certainty about the state, intentions, and activities of one's own forces.[7]

Martin Van Crevald strikes at one of the most difficult challenges of command—gaining situational understanding of your opponent, the environment, and your own forces. There are two competing theories on how to complete this quest for certainty. One theory aims to eliminate uncertainty altogether, and this theory is synonymous with the linear approach to warfare. John F. Schmitt, a retired Marine Corps officer who has written extensively on decision making and the art of command, argues that our linear approach to war was developed as a result of the scientific revolution that began in the 16th century and culminated with Isaac Newton's theories on science and physics.[8] This Newtonian view of the world, and its problems, is characterized by the belief that you can break a system down to its component parts, thus making it easier to understand the relationships between each part and making a complex problem simple. Once the decision maker understands the relationships between the component parts, they are then reassembled back into a coherent whole that is more easily understood.[9] Schmitt uses the analogy of a finely tuned clock to describe this reductionist approach to

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[7] Martin Van Crevald, *Command in War* (Cambridge, MA: Harvard University Press, 1985), 264; quoted in John F. Schmitt and Gary A. Klein, "Fighting in the Fog: Dealing with Battlefield Uncertainty," *Marine Corps Gazette* (August 1996): 62.

[8] John F. Schmitt, "Command and (Out of) Control: The Military Implications of Complexity Theory," In *Complexity, Global Politics, and National Security,* ed. David S. Alberts and Thomas J. Czerwinski, Internet, http://www.ndu.edu/inss/books/complexity/ch09.html, accessed 30 December 2001.

[9] John A. Koenig, "A Commander's Telescope For The 21st Century: Command And

warfare—"finely tooled gears meshing smoothly and precisely, ticking along predictably, measurably and reliably, keeping perfect time."[10] This Newtonian approach to uncertainty is an example of viewing war as a linear, closed system. Within a linear system, each action has a direct and proportionate effect on other parts of that system. These effects can be measured, controlled, and predicted. Schmitt sums up the weakness in this linear theory of war, however, when he states, "War comes to be seen as a one-sided problem to be solved—like an engineering problem or a mathematics problem—rather than as an interaction between two animate forces. In idealized Newtonian war, the enemy, the least controllable variable, is eliminated from the equation altogether."[11]

The second theory defines war as a nonlinear, complex system that is impossible to predict or control. A system composed of many interdependent variables logically results in uncertainty. Clausewitz established the non-linear qualities of war in the following excerpt from *On War:*

> The essential difference is that war is not an exercise of the will directed at inanimate matter, as is the case with the mechanical arts, or at matter which is animate but passive and yielding, as is the case with the human mind and emotions in the fine arts. In war, the will is directed at an animate object that reacts.[12]

This is the weakness in any system or methodology that attempts to eliminate uncertainty; the enemy is "an animate object that reacts." Even if the planner could predict the enemy plan to a reasonable level of accuracy, there are enough feedback loops within the system of conflict to allow the enemy commander to adapt and change

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Nonlinear Science Future War;" Internet, http://192.156.75.135:81/ISYSquery/IRL90EE.tmp/3/doc, accessed 30 December 2001.

[10] Schmitt, "Command and (Out of) Control."

[11] Ibid.

[12] Alan D. Beyerchen, "Clausewitz, Nonlinearity and the Unpredictability of War," *International Security* 17:3 (Winter, 1992): 59-90, Interntet, http://www.dodccrp.org/copapp1.htm. accessed 1 January 2002.

any pre-ordained script that the commander or planner may attempt to force upon the situation.

LINEAR CHARACTERSTICS OF THE MDMP

Even though war is a non-linear system characterized by variability and unpredictability, many decision-making tools attempt to force a linear template onto tactical planning. In Multiattribute Utility Theory, a method of analytical decision-making, the decision maker develops a list of all possible "hypothesis" and then relies on quantitative methods to select the optimal COA.[13] This theory mirrors U.S. Army decision-making doctrine, which aims "to produce the optimal solution to a problem from among those solutions identified . . . this approach is methodical, and it serves well for decision making in complex or unfamiliar situations by allowing the breakdown of tasks into recognizable elements."[14] Within the MDMP, one finds elements of Multiattribute Utility Theory throughout the process. During Mission Analysis, the tactical problem is broken down into its component parts by battlefield function, COA Development produces multiple potential solutions, and a quantitative analysis and comparison of possible solutions is conducted during COA Comparison and COA Approval.

One of the tenets of Multiattribute Utility Theory is that due to the sheer volume of information produced, uncertainty becomes less of a factor. In this paradigm, the key to effective decision-making is the ability to filter through the preponderance of information and select the best plan. That is why many writers on decision-making have enthusiastically adopted technological innovations as the key to preventing information overload and assisting in the computational requirements necessary for analytical

[13] Marvin S. Cohen, Jared T. Freeman, and Bryan Thompson, "Critical Thinking Skills in Tactical Decision Making: A Model and a Training Strategy" in *Making Decisions Under Stress: Implications for Individual and Team Training*, ed. Janis A. Cannon-Bowers and Eduardo Salas (Washington, DC: American Psychological Association, 1998), 156.

decision making. More data not only reduces uncertainty but also facilitates decision making by an inexperienced commander or staff. Historically, in an institution characterized by high turnover and personnel turbulence within its planning organizations and where each group member, including the commander, has different skill sets and levels of experience, analytical decision making has been viewed as the most effective approach.

An environmental aspect of analytical decision-making is time. In order to reduce uncertainty, the decision maker or his staff must gather, analyze, and synthesize a tremendous amount of information. Given enough time, the decision maker should be able to develop multiple possible enemy and friendly COAs and then analyze and compare them in order to produce the best plan. Thus, analytical decision-making is not only dependent on data, but also on time.

The decision maker or planner's challenge, however, is grappling with the non-linearity aspect of warfare, uncertainty. As General Charles C. Krulak, former Commandant of the Marine Corps, points out, "analytical decision making . . . to be effective . . . depends on a relatively high level of situational certainty and awareness."[15] This is the crux of the problem. If there is no fog of war, then the MDMP and other analytical decision making tools are effective because multiple friendly courses of action can be developed against the known enemy course of action and the best course of action selected. War's non-linearity, however, guarantees that the decision maker never completely knows the enemy situation. Doctrine's answer to the difference between linear decision-making and the non-linear environment of war is to generate multiple enemy COAs as well as multiple friendly COAs. Multiple COA development, in theory, reduces uncertainty because it forces the staff to consider all of the options available to

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[14] U.S. Army, *Field Manual 6.0, Command and Control (DRAG)* (Washington, DC: Headquarters, Department of the Army, March 2001), 2-13.

the enemy commander. Even though doctrine prescribes that the staff "identify all COAs that will influence the friendly command's mission,"[16] with an emphasis on the most probable and most dangerous, most staffs consider just two and three COAs.[17] Even though three COAs do not fully encapsulate all possible enemy options, there is a significant time investment required. Evaluating three enemy COAs against three friendly COAs necessitates at least nine iterations of war gaming in order to select the optimum COA. In a tactical environment, this is mentally exhausting as well as overly time-consuming.

Another criticism of the MDMP is that it fails to take into account how decision makers actually think. The MDMP traces its roots to the process developed by the Prussian General Staff during the 19th Century to "systematize military thought, and to deal with complexities of modern warfare, and its inherent mobilization requirements."[18] As war continued to evolve, the Prussians recognized that command and control was a system within the system of warfare that could not reside in one individual, such as a Napoleon. The MDMP is an extension of this perspective. In its reductionist approach to problem-solving, the MDMP not only deals with the increasing complexity of warfare, but also attempts to find the best tactical or operational solution, even if the commander does not possess those inherent qualities that have marked great commanders of the past, such as Patton. In its attempt, however, to capture and standardize the *coup d'oeil* that is the mark of great commanders, the MDMP ignores the underlying cognitive

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[15] Charles C. Krulak, "Cultivating Intuitive Decision making," *Marine Corps Gazette,* (May 1999), 19.

[16] U.S. Army, *FM 34-130 Intelligence Preparation of the Battlefield* (Washington, DC: Headquarters, Department of the Army, July 1994), 2-39 – 2-41.

[17] Based upon the author's experience as a member of a division planning staff (10th Mountain Division, 19 months) and of a CTC training program focused on planning and decision-making (JRTC Leaders Training Program, 16 months). Has also participated in two BCTP Warfighters and numerous planning exercises over a 12 year career.

[18] Marr, *The Military Decision-Making Process*, 11.

processes that shape decision-making.[19] There is much empirical evidence that decision makers do not cognitively generate multiple solutions, compare those solutions, and then select the best one in order to develop a tactical plan. In research on the decision making strategies of Desert Storm battalion and brigade commanders, John Fallesen concluded, that "in general, the doctrinal process of generating three COAs appeared to contribute to inefficient planning when time was short. A better outcome may result when the staff has used the time it would have taken to develop COAs two and three to instead more thoroughly develop and consider a single option."[20] Even in situations where the decision maker is encouraged to generate multiple options, the first course of action developed is most likely the one that he selects as the optimum course of action.[21] While the MDMP may be the preferred strategy when time is not a factor, such as when the problem is characterized by a large degree of computational complexity (e.g., mobilization planning), or the decision maker does not have the experience to use pattern recognition, it does not truly replicate the way human beings think and make decisions.[22] The MDMP places a premium on reasoning and analysis as opposed to judgment, intuition, and insight.[23]

SCOPE

As noted, the linear approach to decision making, epitomized by the MDMP, is effective at dealing with the complexity of many military problems. What is lacking within

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[19] Clausewitz, *On War*, ed. and translated by Michael Howard and Peter Paret, 102. "*Coup d'oeil* . . . refers. . . to the inner eye. . . the quick recognition of a truth that the mind would ordinarily miss or would perceive only after long study and reflection."

[20] John J. Fallesen, "Lessons Learned on Tactical Planning: Implications for Procedures and Training," Army Research Institute Spring 1995 Newsletter, Internet, http://www.ari.army.mil/lesslear.htm, accessed 31 December 2001.

[21] Daniel Serfaty and Michael Drillings, "Naturalistic Decision Making in Command and Control." In *Naturalistic Decision Making*, ed. Caroline E. Zsambok and Gary Klein (Mahwah, NJ: Lawrence Erlbaum Associates, 1997), 74. Both high and low skill chess players demonstrated that the first move selected was often the same move if the player was given an additional 15 minutes of deliberation.

[22] John F. Schmitt, "How We Decide," *Marine Corps Gazette* (October 1995): 18.

[23] Schmitt, "How We Decide," 16.

any of the MDMP steps is a process to manage uncertainty. By adopting a completely linear approach to decision making, managing uncertainty becomes secondary to selecting the best COA. Using the concepts of visualization, anticipation, and flexibility in an environment of limited information, the 8-step war game model should be a critical tool for helping the commander in dealing with battlefield uncertainty. Like the MDMP as a whole, however, the 8-step war game model routinely fails to do this because the development of multiple friendly and enemy COAs actually prevents the decision maker or planner from focusing on understanding his opponent. Its primary function, a comparison tool for multiple COAs, is a linear approach to decision making. The result is that each COA is only superficially addressed due to the limitations of time and mental energy. Another problem of war-gaming friendly COAs against enemy COAs is that it is an inherently competitive process. This competitiveness often leads to groupthink, a common pitfall of group decision-making. [24]

Chapter Two establishes that the problem with the war game begins with the two most important inputs to the war game process, the enemy COA and friendly COA. This is the centerpiece of why the tactical war game is ineffective. Even though producing multiple enemy COAs is supposed to reduce uncertainty, it actually underestimates the enemy commander by assuming that two or three COAs takes into account all of the options and variables that are part of a tactical plan. It is also a time-consuming process in a time-constrained environment. This chapter then examines the role that the current war game model has in encouraging groupthink. Even though doctrine establishes clear rules for avoiding groupthink during the war game, this monograph proves that the

[24] Irving L. Janis, *Groupthink* (Boston, MA: Houghton Mifflin Company 1972), 9. Groupthink is a "a mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members striving for unanimity override their motivation to realistically appraise alternative courses of action."

iterative process of action-reaction-counteraction discourages an objective evaluation of a COA and facilitates the occurrence of groupthink.

The first step in making the war game a more effective tool in managing uncertainty is understanding how decision makers think and plan. Chapter Three examines the qualities that define expert decision-making. This chapter also explores the strengths and weaknesses of a non-linear theory, naturalistic decision-making, and its role as a bridge to critical thinking.

Understanding the potential of naturalistic decision-making establishes the importance of critical thinking as a tool to manage uncertainty. This is the focus of Chapter Four. This chapter also introduces the concepts behind Recognition/Metacognition Theory. R/M Theory leverages the strengths of naturalistic decision making by making it a problem solving strategy as well as a decision-making methodology. This theory offers a way to further refine how we develop enemy and friendly COAs to make them instrumental in generating critical thinking and in dealing with uncertainty. Additionally, Chapter Four explores the Crystal Ball Technique, a process embedded in R/M Theory that offers an alternative to Step 8 of the war game model in order to critically evaluate enemy as well as friendly COAs.

Chapter Five integrates previously analyzed decision-making tools, decision-making characteristics, and decision-making theory to create a process that encourages critical thinking, a quality of expert decision makers. Incorporating the tenets behind R/M Theory within the MDMP produces steps geared specifically toward managing uncertainty. This chapter recommends blurring the lines between COA Development and COA Analysis. Since COA Development is instrumental in setting the stage for successful war gaming, improvements made to the two most important inputs to the war game process, the enemy COA and the friendly COA directly improve the war game effort. While a critical examination of the six steps that define COA Development is

beyond the scope of this monograph, this monograph determines that COA Development does not provide the COA product needed for effective war gaming. This monograph recommends a concluding step to the current 6-step model of COA Development, focused on critically evaluating the friendly COA. This additional step to COA Development and a corresponding "Enemy COA Development" step, added to the MDMP will produce fully developed, synchronized COAs that have been critically examined within each respective COA development step as opposed to dedicating a separate step to war game multiple COAs. This monograph also recommends replacing COA Analysis, COA Comparison, and COA Approval with a new step titled Contingency Planning. Contingency Planning draws upon the assumptions and conflicts in information produced in the development of both the friendly and enemy COA to create contingency plans that better prepare the commander to react to uncertainty. The endstate is a process that leverages the power of critical thinking in order to manage the effects of uncertainty within the context of a group planning process.

CHAPTER TWO

WHY THE 8-STEP WAR GAME MODEL FAILS AS A PLANNING TOOL

THE U.S. ARMY 8-STEP WAR GAME MODEL

Even though the origins of war games exist in both western and eastern ancient cultures, modern war gaming traces its lineage to a Prussian lieutenant, von Reisswitz, who in 1811, formalized war gaming by incorporating detailed rules to add structure to the process.[25] This formalized, very rigid war game eventually evolved into the freeform game developed by Colonel von Verdy du Vernois in 1876. This model would serve as the basis for the series of war games, or Kriegsspiels, that became planning tools in the development of war plans for both World War I and World War II by the German General Staff.[26] These early versions of modern war gaming serve as the basis for the U.S. Army's tactical war-gaming, as well as more elaborate war games and simulations conducted at the strategic level. This monograph focuses on war gaming at the tactical level, using the war gaming model outlined in Field Manual 5.0, *Army Planning and Orders Production (Initial Draft)*.

> FM 5.0 defines war-gaming as:
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> A disciplined process, with rules and steps that attempt to visualize the flow of a battle. The process considers friendly dispositions, strengths, and weaknesses; enemy assets and probable COAs; and characteristics of the area of operations. It relies heavily on a doctrinal foundation, tactical judgment, and experience.[27]

As the definition above states, the tactical war game is a sequential process embedded within the sequential MDMP. Figure 1 is a graphical representation that outlines the

[25] Gary D. Brewer and Martin Shubik, *The War Game: A Critique of Military Problem Solving* (Cambridge, MA: Harvard University Press, 1979), 48.
[26] Ibid., 49.
[27] *FM 5.0 Army Planning and Orders Production*, 4-24.

inputs from previous steps that drive the war game, the 8 steps of the war game itself, and the outputs from the war game that drive the remainder of the decision making process.

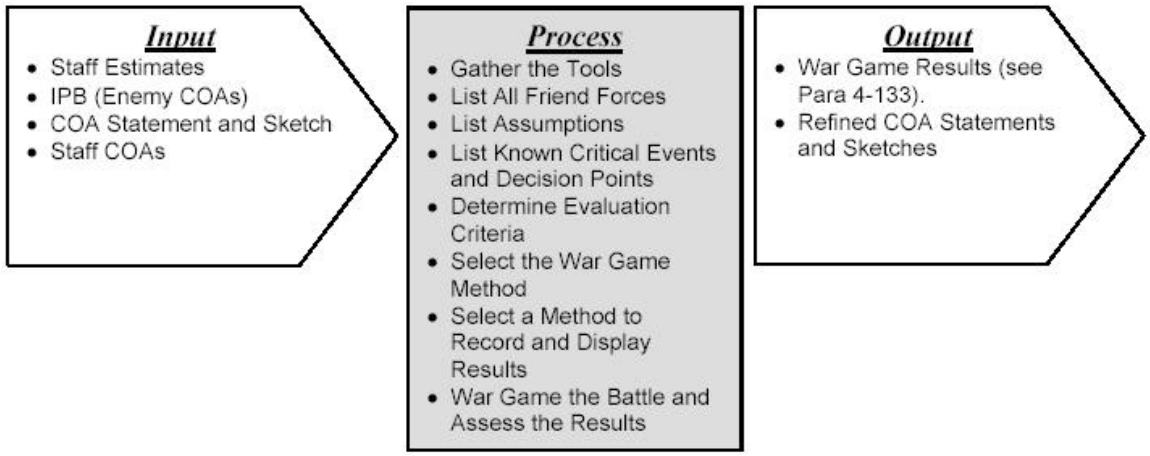

Figure 1. War Game Inputs, Process, Outputs[28]

A full explanation of each process step can be found in FM 5.0, but there are two steps in particular that fall within the scope of this monograph: Step 1, Gather the Tools, and Step 8, War Game the Battle and Assess the Results. Subsequent chapters will explore both of these steps and their relationship to linear decision-making. The rules that govern war gaming, the responsibilities of key members of the staff, and the goals of war gaming are also covered to establish the baseline to assess Step 1 and Step 8.

A common failing observed at the Combat Training Centers is that staffs fail to meet the standards for Step 1, Gather the Tools, and come to the war game with incomplete COAs that lack the detail to drive the war game process.[29] Compared to other war game tools, like staff estimates, logistics and personnel calculations, and movement rates, completed COAs are arguably the most important tool for setting the

[28] Ibid., 4-24.

[29] Center for Army Lessons Learned, *NTC TRENDS COMPENDIUM 3QFY97 through 2QFY98, 3QFY98 through 4QFY99,* and *JRTC TRENDS AND TTPs, 4th Qtr FY99 & 1st Qtr FY00 NO. 01-6,* Internet, http://call.army.mil/homepage/ctcbull.htm, accessed 15 October 2001.

conditions for a successful war game. Incomplete COAs force the staff to finish developing the COA during the war game, which adds to the time necessary to complete the process. This becomes even more problematic when attempting to war game multiple COAs. This problem is not limited to friendly COA development, but holds true for enemy COA development also. Without both a complete enemy and friendly COA that includes a scheme of maneuver, graphics, collection plan, decision points, and options available to the commander, war gaming, whether it is an iterative process between the G2 and G3 or part of a critical thinking strategy, is destined to fail.

The heart of the war game is the action, reaction, counteraction cycle that occurs during Step 8, War Game the Battle and Assess the Results. A member of the G3 and G2 section leads this iterative process that involves the entire planning staff. As each friendly COA is war gamed against an uncooperative enemy, portrayed by a staff member role-playing the enemy commander, the staff should discover enemy vulnerabilities to exploit, friendly vulnerabilities to protect, when and where critical decisions have to be made, and when and where to apply different battlefield functions to achieve decisive results. The next step of the MDMP then compares the advantages and disadvantages of each COA that have been identified during this last step of the tactical war game model. Even though there is historical data to guide the planning staff as they assess the results of each friendly or enemy action, the process is largely a subjective assessment that relies on the experience and objectivity of the staff to produce an unbiased product. This historical data has become less relevant as the U.S. Army prepares to fight against asymmetrical enemies who do not follow an established pattern or doctrine.

To prevent the commander from influencing one or two members, or from dominating the staff, doctrine has established rules focused on maintaining objectivity. As listed in FM 5.0, these rules are to: “remain objective, not allowing personality or their

sensing of "what the commander wants" to influence them; accurately record advantages and disadvantages of each COA as they become evident; continually assess feasibility, acceptability, and suitability of the COA; avoid drawing premature conclusions and gathering facts to support such conclusions; and avoid comparing one COA with another during the war game." [30]

Each staff member has specific responsibilities within the war game that align with his or her specific expertise. For example, the G3 as the lead maneuver planner not only has the responsibility to organize and assign additional tasks to staff members, but also plays the friendly commander during the war game while the G4 focuses on the sustainment feasibility of each COA. Along with the G3, two other individuals have a critical role in affecting the flow and outcome of the war game. The counter to the G3 is the G2 who role-plays the enemy commander. His primary responsibility is to keep the process "honest" by ensuring that the staff addresses friendly responses for each enemy COA "by trying to win the war game for the enemy."[31] He or she also has friendly responsibilities to refine the event template and identify enemy high pay-off targets. The Chief of Staff or the Executive Officer is the staff member who directs the war game thus, "ensuring the staff stays on a timeline and accomplishes the goals of the war gaming session."[32] More importantly, however, the Chief of Staff is the "unbiased controller of the process."[33] He assumes responsibility for ensuring that the staff remains objective and does not succumb to the pressures of group dynamics.

FM 5.0 provides a list of 31 outcomes for the war game process.[34] While this list addresses the primary responsibility of war-gaming, evaluating a COA for subsequent steps of the MDMP, it also addresses other concepts such as synchronization, resource

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[30] *FM 5.0 Army Planning and Orders Production*, 4-25.
[31] Ibid., 4-25-4-26.
[32] Ibid., 4-25.
[33] Ibid., 4-25.

allocation, and targeting. Uncertainty, though not explicitly stated in this list, is another important aspect of tactical war gaming. CCIR (Commander's Critical Information Requirements), the event template, branches and sequels, and the decision support template, all products of tactical war gaming, help the commander anticipate battlefield events, react to unexpected enemy COAs, and create shared visualization with the staff. The ability to anticipate, quickly react to unexpected or unforeseen events, and visualize are critical to removing doubt from decision-making.

Successful war gaming depends upon the staff's capability to execute a time-consuming process, war-gaming multiple COAs, in a time-constrained environment while maintaining objectivity. While many have argued that well-trained staffs can overcome this incongruence of time, creating multiple COAs is a linear approach to decision making that attempts to refine all of the options available to a enemy commander to two or three specific COAs. This specificity facilitates comparing COAs, but at the expense of anticipation, flexibility, and visualization, all concepts used to deal with uncertainty. Likewise, the competitive nature of the action, reaction, counteraction cycle is at odds with maintaining objectivity. Competition encourages staff members to defend their COA; to become personally wedded to their plan. Even though doctrine explicitly cautions against personal identification with COAs, Step 8 of the war game model is an obstacle to maintaining objectivity.

THE PITFALLS OF GROUP DECISION MAKING

FM 5.0 warns of the danger of "groupthink" whenever staffs work together to make decisions or solve problems. Groupthink is a "a mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members striving for unanimity override their motivation to realistically appraise alternative courses

[34] Ibid., 4-33 – 4-34.

of action."[35] Even though FM 5.0 prescribes specific rules to avoid groupthink, no checks are in place in the MDMP to ensure adherence to these rules.

The military staff organization is an instrumental tool in effective planning and decision-making. Accordingly, decision making strategy, whether its analytical or intuitive, is subject to group dynamics. Irving Janis, a noted researcher on the group decision-making process, coined the term groupthink to describe the inherent pitfalls that occur during group planning. Another definition of groupthink is "an unconscious process where pressures toward group unity take precedence over rational decision-making."[36] This focus on group unity also leads to pluralistic ignorance—those who disagree with the initial COA believe they are the only ones with objections so they never express them.[37] The result is that these group dynamic pressures lead to a lack of contingency planning and a failure to gain situational understanding.[38]

FM 5.0, using guidelines developed by Janis, establishes some basic rules to follow in order to avoid groupthink.[39] These rules attempt to avoid groupthink through awareness of the problem. If the group, especially the group leader, understands what groupthink is, then they can avoid it through open communication, and thus refrain from steering the group toward a potential course of action. Even though FM 5.0 does

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[35] Janis, *Groupthink* 9.

[36] Gordon Hodson and Richard M. Sorrentino "Groupthink and Uncertainty Orientation: Personality Differences in Reactivity to the Group Situation" in *Group Dynamics: Theory, Research, and Practice* 1 (1997): 144-155

[37] Marvin E. Shaw, *Group Dynamics: The Psychology of Small Group Behavior* (New York: McGraw Hill Book Company, 1976), 401.

[38] Janis, *Groupthink*, 10.

[39] *FM 5.0 Army Planning and Orders Production*, 2-8. These rules are developed from Irving L. Janis in *Victims of Groupthink*, 209-218:

- The group leader should encourage members to express their objections or doubts
- The presenter of a problem to a group should refrain from expressing preferences about potential solutions
- Two independent subgroups can work on the problem
- The group leader should ask people outside the group for input
- The group leader should assign at least one member of the group the role of devil's advocate
- After reaching a preliminary consensus, the group should go back and reconsider previously considered alternatives.

recommend that at least one person play the role of devil's advocate, the ability to follow these rules depend on the personality of the group leader.

In his research on groupthink, Janis recommends one other aspect of preventing groupthink that FM 5.0 does not fully explain. Not only is a devil's advocate required, but each group member should be a "Cassandra's advocate, challenging his or her own favorite arguments and playing up the risks."[40] This over reliance on the role of the leader to avoid groupthink can also be problematic. Current research on group decision-making indicates that there are "mixed results" in demonstrating the group leader's effect in preventing groupthink.[41] What is missing from our doctrine on decision making is a methodology embedded within the process itself that lessens the dangers of groupthink and makes every staff member a "Cassandra's advocate."

THE EFFECT OF A LINEAR PERSPECTIVE AND GROUP DYNAMICS ON THE U.S. ARMY TACTICAL WAR GAME MODEL

In Step 1 of the war game model, one of the primary inputs is the multiple friendly and enemy COAs. This is an extension of the linear approach to decision making embodied by the MDMP. As noted earlier, this linear approach requires multiple war games in order to select the best COA and can be extremely time-consuming. Time is a finite resource. The time required to war game multiple COAs results in less time devoted to products, such as CCIR development, branches and sequels, and the DST, needed to reduce the effects of uncertainty. Instead of helping the commander handle the uncertainty of warfare, the war game's reliance on multiple enemy and multiple

[40] Janis, *Groupthink*, 271. Cassandra's advocate is a reference to Cassandra, the daughter of Priam and Hecuba, King and Queen of Troy at the time of the Trojan war. She was also a prophetess who spurned the advances of Apollo. He then cursed her so that no one believed her catastrophic prophecies even though they proved to be true.

[41] "Groupthink and Uncertainty Orientation: Personality Differences in Reactivity to the Group Situation." Gordon Hodson and Richard M. Sorrentino. *Group Dynamics: Theory, Research, and Practice* 1 (1997): 236.

friendly COAs as one of its primary inputs means that there is not a focused effort to facilitate concepts aimed at reducing uncertainty: anticipation, flexibility, and visualization.

The key to anticipating enemy events on the battlefield is understanding the right questions to ask in order to seek the right information. CCIR, the event template, and the collection plan are information-gathering tools that help the commander gain situational understanding. The event template, the blueprint of the enemy commander's anticipated key decisions, graphically depicts in time and space where the commander can exploit opportunities and protect against risk. The event template facilitates the identification of both friendly and enemy information requirements required to make decisions that "dictates the successful execution of operational or tactical operations."[42] These information requirements become CCIR and helps focus the collection plan. Using these tools, anticipation is achieved by seeking information that either shapes or predicts future enemy actions.

The MDMP, like any decision tool that operates in an environment of uncertainty, relies on assumptions to fill in gaps or resolve conflicts in information. Assumption-based planning is only successful if the commander develops flexible plans that include contingencies to offset those assumptions that prove to be wrong. This is the methodology behind developing branches and sequels, a stated goal of the current war game model. Branches and sequels offset the inflexibility of the assumption that one or two enemy COAs are an accurate prediction of the enemy plan.

Visualization is "the process of achieving a clear understanding of the force's current state with relation to the enemy and environment, developing a desired end state that represents mission accomplishment, and determining the sequence of activity that

[42] *FM 6.0, Command and Control*, Glossary-1.

moves the force from its current state to the end state."[43] One of its main factors is "visualizing the dynamics between the opposing forces during the sequence of actions leading from the current situation to the end state."[44] The DST is a graphical representation of the dynamics between the two opposing forces. It includes "decision points and projected situations and indicates when, where, and under what conditions a decision is most likely to be required to initiate a specific activity, such as a branch or sequel, or event."[45] Not only is the DST important to visualization, but it also incorporates anticipation and flexibility by linking CCIR and branches and sequels to the friendly scheme of maneuver.

The current war game model lacks the dynamism that is crucial to achieving situational understanding because it never uncovers and tests the hidden assumptions that are part of the enemy COA. These hidden assumptions, in effect, become the enemy commander's branches and sequels. Overlooking this step creates a domino effect. Without considering the effect of hidden assumptions with the enemy COA, the event template becomes a marginal product to drive the development of CCIR because it only focuses on those decisions that are different from the two or three enemy COAs. In the current model, with its emphasis on war-gaming multiple COAs, contingency planning is not a priority. This prevents the commander and staff from visualizing and "evaluating possible enemy reactions and friendly counters to those moves."[46] Without contingency plans, the friendly commander lacks the flexibility or agility to react to unexpected events on the battlefield. The primary function of the war game should be to uncover those hidden assumptions that are formulated during the development of enemy

[43] Ibid., 2-17.
[44] Ibid., 2-18.
[45] Department of the Army, *FM 101-5-1 Operational Terms and Graphics* (Washington, DC: Headquarters, Department of the Army, 30 September 1997), 1-46.
[46] Ibid., 2-18.

and friendly COAs, and developing contingency plans in order to react if the assumption proves false.

Step 8 of the war game model is a competitive exercise between two groups, usually the COA team led by the G-3 or S-3 and the enemy team led by the S-2 or G-2, who attempt to win the battle through the iterative process of action-reaction-counteraction as a means of discovering weaknesses in the friendly COA. This compels the staff member to defend his COA, which is counter to decision-making doctrine. The only person specifically tasked to remain unbiased is the Chief of Staff or the XO, which can be problematic due to his level of involvement in the process. Not only does it succumb to the competitive nature of each team, but is also assumes away all uncertainty. Each team views the opponent's move and then develops a counter-move. Other staff members synchronize their battlefield function either in support of friendly moves or against enemy moves. The decision maker is able to create a visualization of the battlefield that relies on 100% situational understanding. This reduces decision making to a game of chess in which each player knows his opponent's move and strategy before the game begins.

The MDMP, like the 6-step problem solving model, aims at an exhaustive analysis and evaluation of all possible solutions, but fails to take into account how human decision makers shape and define the problem.[47] It is a model for evaluating different COAs, but it does not analyze the problem in line with how the human decision maker thinks. The discovery of a problem-solving strategy that does mimic the human cognitive process requires an understanding of how the decision maker thinks, which is

[47] FM 5.0 defines problem solving as "the art and science of defining a problem, developing alternative solutions, and deciding on the best solution." Thus, the MDMP is an extrapolation of the 6 step problem solving model that seeks to: recognize and define the problem, gather information relative to the problem, list possible solutions, test possible solutions, select the best solution, and implement the solution.

the subject of the next chapter. This sets the stage for identifying an approach to war gaming that generates critical thinking within a group-planning context.

CHAPTER THREE

THE EXPERT DECISIONMAKER

CPT Kenneth F. McKenzie, Jr. sums up the difference between the novice and the expert decision maker in the following statement: "We're forcing a multiple choice answer on what should be an essay question."[48] Numerous studies have demonstrated that expert decision makers "tended to see the situation as more complex" than novices.[49] Expert decision makers also were able "to handle adversity, to identify exceptions, and to adapt to changing conditions."[50] By embracing complexity, expert decision makers are able to, as one researcher describes it, develop a "richer mental model."[51] Mental models are "deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action."[52] Mental model development is a common feature of the research on expert decision-making and is an important component of critical thinking.[53] In *The Fifth Discipline*, Peter Senge wrote extensively on the use of mental models in the business community—with both positive and negative results. The power of mental models is that they help "managers clarify their assumptions, discover internal contradictions in those assumptions, and think through new strategies based on new assumptions."[54] From this description, two concepts stand out—reflective thinking and contingency planning.

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[48] CPT Kenneth F. McKenzie, Jr., "The Flash of the Kingfisher," *Marine Corps Gazette* (April 1990): 72.

[49] Marvin S. Cohen, Bryan B. Thompson, Leonard Adelman, Terry A. Bresnick, and Lokendra Shastri, *Training Critical Thinking for the Battlefield, Volume I: Basis in Cognitive Theory and Research* (Arlington, VA: Cognitive Technologies, Inc., 2000), Technical Report 00-2, 17.

[50] Ibid., 17.

[51] Daniel Serfaty, Jean MacMillan, Elliot E. Entin, and Eileen B. Entin, "The Decision-Making Expertise of Battle Commanders," In *Naturalistic Decision Making* ed. Caroline E. Zsambok and Gary Klein (Mahwah, NJ: Lawrence Erlbaum Associates, 1997), 237.

[52] Senge, Peter M. *The Fifth Discipline*: *The Art & Practice of the Learning Organization* (New York, NY: Doubleday, 1990), 8.

[53] Serfaty, et al., "The Decision-Making Expertise of Battle Commanders," 242-243; Cohen, et al., *Training Critical Thinking for the Battlefield, Volume I,* 80.

[54] Senge, *Fifth Discipline*, 178.

Senge uses the phrase “skills of reflection” to describe the process by which the decision maker questions how he came to form his mental model and the ways it influences his actions.[55] It is through the development of skills of reflection that the expert decision maker begins to discover hidden assumptions, and these hidden assumptions become the foundation for contingency planning. The findings of a study conducted by researchers from ALPHATECH support the power of mental models used by expert decision makers as proposed by Senge. This study evolved from 46 interviews with U.S. Army officers who ranged in rank from Captain to General. A battlefield scenario set in the Persian Gulf was presented to each officer. They produced both written products and verbally explained the rationale for their solution to the tactical problem. The experts who judged the levels of expert decision-making were retired three and four star generals. While expert decision makers did not develop an initial COA any faster than the novices, their COAs were much more complex. Consequently, the expert decision makers had a clearer understanding of gaps and conflicts within their mental models; they were able “to ask the right questions, and to gather the most relevant information.”[56] The expert decision makers were also able to use mental models to better visualize the outcomes of their COAs, determine what could go wrong with their plan, and then develop contingencies to deal with “showstoppers” they encountered as a result of visualization.[57] This is consistent with the theory that mental models are effective tools that help the decision maker discover the hidden assumptions that form the basis of his COA, test those assumptions for validity, and prepare assumption-based contingencies. Through this process, the decision maker not only gains situational understanding of when the plan is failing, but also understands when the plan is succeeding and is able to recognize opportunities.

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[55] Ibid., 191.
[56] Serfaty, et al., “The Decision-Making Expertise of Battle Commanders,” 237.

By the nature of the environment, uncertainty will always breed assumptions. However, the key to effective decision-making is determining which assumptions are plausible, and discovering conflicts within your assumptions and your mental model. Research on the way naval officers make decisions in the high-stress environment of a naval combat information center (CIC) has concluded that experts are better at discovering conflicts in their assumptions and mental models and then generating alternative scenarios to support their assumptions or resolving conflicts.[58]

In summary, the number of years of military service does not define decision-making expertise. The expert decision maker distances himself from the novice through the development of complex mental models about the enemy as well as friendly forces. This is analogous to the development of enemy and friendly courses of action within the current MDMP. There is one critical difference; the expert rigorously screens his mental model for gaps and conflicts in information and weak or implausible assumptions. The expert conducts this examination through a reflective process of critical thinking that ensures that the expert decision maker "will be less likely to miss or fail to account for significant data; they will be less likely to overlook unreliable assumptions or conflicts in the data; and they will be less likely to engage in excessive explaining away (confirmation bias).[59] This is the essay approach to decision making that CPT McKenzie describes; the expert decision maker designs a mental model that makes logical sense, as opposed to selecting from a list of COAs.

THE FIRST STEP IN CRITICAL THINKING—NATURALISTIC DECISION MAKING

The certainty of data and the luxury of time are unattainable goals according to those who advocate naturalistic decision making over an analytical approach.

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[57] Ibid., 243.
[58] Ibid, 35.

"Timeliness is a critical factor in most military decisions. Uncertainty and ambiguity are pervasive characteristics of practically all military decision making."[60] Analytical decision-making is a methodology best suited for a closed system, one that is not vulnerable to outside variables. Decision-making and planning, however, occurs in a "naturalistic environment." A naturalistic environment is characterized by: ill-structured, situation-unique problems, uncertain, dynamic environments, shifting, ill-defined or competing goals, lack of information, ongoing action with continuous feedback tools, high-level stress and friction, and time stress."[61] Naturalistic decision-making attempts to leverage experience and intuition to offset the reliance on data and time that characterize classical decision theory. Feature matching, reasoning by analogy, and mental simulation—rather than data and time—form the theoretical foundation of naturalistic decision making. Feature matching is the process of identifying relevant cues or patterns that help define the problem. The decision maker identifies the relevant pattern and then matches those cues or patterns to a previous experience through reasoning by analogy.[62] The analogy provides framework to the cues or patterns that the decision maker has identified. Both of these processes draws upon the experience of the decision maker to develop a set of "automatic responses to recognized patterns."[63]

Mental simulation is the development of a story or scenario around the recognized pattern that describes actions and events that will occur from an initial state to some point in the future.[64] Mental simulation gives meaning to these cues or patterns and fills in the gaps of the analogy. Not only does it help identify weaknesses in the

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[59] Ibid., 80.
[60] Schmitt, "How We Decide," 17.
[61] Ibid., 18.
[62] John A. Koenig, "A Commander's Telescope For The 21st Century: Command And Nonlinear Science Future War," Internet, http://192.156.75.135:81/ISYSquery/IRL90EE.tmp/3/doc, accessed 30 December 2001.
[63] Cohen, et al, "Critical Thinking Skills in Tactical Decision Making," 157.
[64] Koenig, "A Commander's Telescope for the 21st Century."

plan, but it also generates expectations about success and helps the decision maker identify opportunities.[65]

Field Marshall Slim, who commanded the 10th Division, the 1st Burma Corps, and the 14th Army in Burma during World War II, is an historical example of a decision maker drawing upon his previous experiences to solve a current problem. Prior to experiences developed during World War II, Slim "saw significant action during World War I."[66] In his memoirs, *Defeat into Victory,* Slim described his thoughts as he prepared to cross the Irrawady River as part of an offensive to destroy the Japanese Army:

> I drew comfort, too, at this time from quite another thought. I had, more than once, in two great wars, taken part in the forcing of a river obstacle, and I had on every occasion found it less difficult and less costly than expected. I had read some military history, and although I cudgeled by brains, I could not call to mind a single instance when a river had been successfully held against determined assault.[67]

Drawing upon his experience in both world wars and study of military history, Slim identified relevant cues between the Irrwady River operation and past river crossing operations, crafted an analogy which incorporated the relevant cues, and then using mental simulation to fill in the gaps, or resolve conflicts, within the analogy generated expectations of success. Instead of developing alternate courses of action to the river crossing and then comparing those courses of action, he draws upon his experience and intuition to quickly make a decision.

WEAKNESS OF NATURALISTIC DECISION MAKING

Pattern recognition, a characteristic of naturalistic decision making, is an instinctual element of the human cognitive process. John Koening uses the analogy of

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[65] Gary Klein, *Sources of Power: How People Make Decisions* (Cambridge, MA: The MIT Press, 1999), 89.

[66] Arthur J. Athens, *Unraveling the Mystery of Battlefield Coup d'oeil* (SAMS Monograph, U.S. Army Command and General Staff College, 1993), 22.

[67] Viscount Slim, *Defeat into* Victory (London: Papermac, 1987), 413; quoted in Arthur J. Athens, *Unraveling the Mystery of Battlefield Coup d'oeil,* 25-26.

"a coyote that sees a rat's tail extending from a clump of grass. His brain is able to fill in the missing information, realize a rat is in the grass, and get his next meal. The coyote's conclusion that there is a rat in the grass flows from his visual system activating conditioned neurons -- a basin of " attraction" -- which fills in the picture."[68] In analytical decision-making, the focus is on COA generation and selection of evaluation criteria, while naturalistic decision-making places emphasis on identifying cues that will trigger pattern recognition. Not only is this process more closely aligned with the way that human beings think, but it also places a premium on situational understanding. Another finding from Fallesen's research on tactical decision-making is that "over two thirds of information used was obtained passively. When information was desired . . . only one third of the time was that information sought."[69] Intuitive decision-making compels the decision maker to fill in the gaps of the pattern. Aggressively seeking situational awareness and understanding are critical components to filling in those gaps. The process, however, relies on the decision maker being able to recognize those relevant cues, and based on experience, to assemble those cues into a pattern that leads to an effective course of action. The weakness of intuitive decision-making occurs when the decision maker encounters a novel situation that does not have any linkages to experience or when the decision maker lacks the required experience base to engage in pattern recognition.[70] This becomes especially relevant as the military engages asymmetrical, patternless enemies. In these examples, the gaps in the pattern become so great that the decision maker is unable to generate a story, or mental model, to explain the situation. Without the necessary experience, the decision maker cannot

[68] John A. Koenig, "A Commander's Telescope For The 21st Century: Command And Nonlinear Science Future War."

[69] Fallesen, "Lessons Learned on Tactical Planning: Implications for Procedures and Training."

[70] Cohen, et al., "Critical Thinking Skills in Tactical Decision Making: A Model and a Training Strategy," 157.

determine if unreliable or conflicting data has corrupted his cues. Recognition/Metacognition Theory (R/M Theory), which will explored further in Chapter Four, takes advantage of the strengths of naturalistic decision-making but also overcomes the reliance on experience by developing critical thinkers.

CHAPTER FOUR

LINKING MENTAL MODELS TO CRITICAL THINKING

THE POWER OF CRITICAL THINKING AND MENTAL MODELS

Maneuver warfare, a critical component of Army doctrine, emphasizes concentrating combat power to achieve surprise, shock, momentum, and dominance in order to achieve a position of advantage with respect to the enemy.[71] Maneuver considerations not only refer to the movement of combat forces but also directly relate to a subsequent application of firepower. Information, another element of combat power, "magnifies" the effects of maneuver and firepower to achieve shock by attacking the way the enemy commander makes decisions.[72] To leverage information and other elements of combat power, the commander must develop situational understanding to understand how the enemy commander fights, what options are available to him, what critical decisions have to be made by the enemy, and what are his critical vulnerabilities. Critical thinking is the tool that allows "Army forces to see first, understand first, and act first."[73]

Critical thinking traces its roots to Socrates who "established the importance of seeking evidence, closely examining reasoning and assumptions, analyzing basic concepts, and tracing out implications not only of what is said but of what is done as well."[74] Two philosophers, Matthew Lipman and Michael Scriven have defined critical thinking as being "self-correcting and . . . sensitive to context" and "the skill to identify the

[71] Department of the Army, *FM 3.0, Operations* (Washington, DC: Headquarters, Department of the Army, June 2001), 4-4.
[72] Ibid., 4-10.
[73] Ibid., 4-11.
[74] Richard Paul and Linda Elder, *Critical Thinking: Tools for Taking Charge of Your Learning and Your Life* (Upper Saddle River, NJ: Prentice-Hall, 2001), 375.

less obvious alternatives to positions, claims, arguments, generalizations, and definitions, and to evaluate alternatives with reasonable objectivity."[75]

Critical thinking provides the bridge between linear and non-linear decision-making. The complexity of present-day military operations requires a reductionist, analytical approach epitomized in Mission Analysis and staff estimates. Critical thinking, however, guards against the weaknesses of linear decision making through the discovery of gaps, conflicts, and unreliable assumptions embedded within both the friendly and enemy COA. [76] The active discovery of gaps, conflicts, and assumptions in the enemy COA precludes the generation of multiple enemy COAs and friendly COAs. Critically thinking about the assumptions that form the enemy and friendly COA also facilitates the development of alternative plans to address discontinuities within the COA. Contingency planning, in the absence of multiple COAs, is now elevated to its proper place in the MDMP. A critical thinking strategy also provides the framework to avoid groupthink. The reflective aspect of critical thinking challenges the decision maker to question his own assumptions and conclusions forcing decisions void of bias.

Mental models are the foundation for understanding how the enemy commander will fight. In this context, mental models are "a succinct summary of events or ideas, which shows how each event or idea is linked to achievement of a purpose."[77] Even though the term mental models may be unfamiliar to some, the underlying concepts behind mental models are embedded in the MDMP. Doctrinally, enemy and friendly courses of action, decision support matrices, and decision support templates generate mental models for decision makers. Eventually, this mental model becomes the basis

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[75] Ibid., 371-372.

[76] Marvin S. Cohen, et al., *Training Critical Thinking for the Battlefield, Vol. I-III*. The thesis of this three-volume study is focused on applying critical thinking strategies to the use of mental models through the technique of finding information gaps and conflicts and unreliable assumptions.

[77] Marvin S. Cohen, Bryan B. Thompson, Leonard Adelman, Terry A. Bresnick, Lokendra Shastri, *Training Critical Thinking for the Battlefield, Vol. II* (Arlington, VA: Cognitive Technologies), 2000), 24.

for shared visualization between the commander and the staff. Once it is complete, the mental model, in its various forms, should address the commander's focus for the collection effort, the depth of contingency planning, and how the commander intends to act within the enemy commander's decision cycle. Before the commander reaches this level of shared visualization, he must first have situational understanding; he must understand the current state of friendly and enemy forces and their relationship to each other.[78] Commanders achieve this level of situational understanding by *thinking* about the information and assumptions that form their mental models.

Marvin S. Cohen, a researcher on decision-making, has drawn upon research conducted over the last 15 years that focuses on decision making within a naturalistic setting. He has combined it with his own observations from research projects that studied decision making in a Navy and Army environment and developed a critical thinking strategy that focuses on the role of mental models and initiative.[79] Cohen found that many officers, when involved in decision-making, develop what he terms, mental models about the enemy commander's intent. Cohen's mental models of enemy commander's intent and developing enemy COAs both focus on aspects such as enemy capabilities, enemy doctrine, the personality of the enemy commander, the enemy's probable mission, force ratios, equipment, enemy leadership, terrain, weather, etc.[80] Once these mental models are developed, the expert decision maker will engage in critical thinking to find gaps, conflicts and hidden assumptions. This process drives intelligence collection because the planner actively seeks out information to fill in the gaps or resolve conflicts in the model. The planner also gains an appreciation of the possible branches and sequels available to the enemy commander through the

[78] *FM 6.0, Command and Control*, 2-17.
[79] Ibid., *Volume 1: Basis in Cognitive Theory and Research*, 3.

discovery of the hidden assumptions that underlie his model. The result is a product that helps the commander "to understand how the enemy views success and the options available to the enemy . . . recognize enemy vulnerabilities and possible opportunities. Only then can the commander develop plans to counter and eliminate enemy options."[81] In doctrinal terms, this product is an enemy DST or DSM. The planner can now develop plans that shape the enemy decision making cycle and develop contingency plans to counter enemy options.

AN EXAMPLE OF CRITICAL THINKING

There are three questions that critical thinking should answer: is important information missing from the mental model; do different information sources, tasks, and/or purposes, conflict; and do important conclusions or plans depend on untested assumptions?[82] These three questions are the link between critical thinking and the decision making process. Using this theory, the staff officer or commander first creates a mental model that explains the enemy commander's intent and purpose. He then takes this story and finds gaps or conflicts. For example, Cohen uses the following example to demonstrate the use of mental models.[83] A division plans officer has to determine the location of an enemy attack. The officer takes into account that the enemy has had the greatest success in the south, and that both his most likely goal, city

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[80] Ibid., *Training Critical Thinking for the Battlefield*, 24 and Headquarters, Department of the Army, *FM 34-130, Intelligence Preparation of the Battlefield* (Washington, DC: Department of the Army, 1994), 2-34.

[81] Charles W. Innocetti, *Abbreviated Military Decision making for Brigade Combat Team*, (MMAS Thesis, U.S. Army Command and General Staff College, 2001), 5.

[82] Cohen, et al., *Training Critical Thinking for the Battlefield Vol. II*, 28.

[83] Marvin S. Cohen, Jared T. Freeman, and Bryan B. Thompson, "Training the Naturalistic Decision Maker." In *Making Decisions Under Stress: Implications for Individual and Team Training*, ed. Caroline E. Zsambok and Gary Klein (Mahwah, NJ: Lawrence Erlbaum Associates, 1997), 258-261. 34 active-duty Army officers participated in a think-aloud problem solving session in which they were presented with the following scenario: "A division plans officer is trying to predict the location of an enemy attack. The enemy has had the greatest success in the south, which the enemy is likely to want to exploit; its most likely goal, city Y, is in the south; it has the best supplies in the south; and the best roads are in the south."

Y, and the best roads are located in the south. He therefore develops a mental model that the enemy will attack in the south. In this example, his mental model revolves around past enemy experience, enemy intent and purpose, and the terrain. The division planner then takes this initial model and discovers gaps where the story is incomplete. The first gap is that the planner has not observed enemy actions supporting the original mental model. Secondly, what are the enemy capabilities that support an attack in the south or the north? What is the relative strength of enemy armor, artillery, engineering, and leadership in the north vs. the south and what impact does this have on the enemy plan? The genesis of the collection and the R&S plan begins as the planner attempts to find the answers to these questions.

The next stage in critical thinking is finding the conflicts in the mental model. In Cohen's scenario, the planner determines that leadership and troop strength are superior in the north. This supports a model that the enemy will attack in the north, which is in conflict with the original COA that the enemy will attack in the south. In order to resolve this conflict, the planner may attempt to find more information or generate assumptions to explain the conflict. Two assumptions that the planner could draw may be that enemy troop strength is not an indicator of the enemy's main effort or that the enemy is still planning a main attack in the south, based upon the original mental model, and that the attack in the north is a supporting effort.

The third stage of critical thinking is analyzing the assumptions produced during the formulation of the original mental model and those created to explain gaps and conflicts in the mental model for reliability. This process will discount some assumptions because of unreliability, accept others within the model, and generate additional ones as other gaps and conflicts are discovered and unreliable assumptions thrown out. This is not a static process; as the planner gains new information or assumptions prove unreliable, he continues to engage the critical thinking process. The strength of this

methodology, as Cohen points out, is that it "facilitates evaluation of a model by reducing all considerations to a single common currency; the reliability of its assumptions."[84]

INITIATIVE

This critical thinking strategy provides the means to understand the enemy's decision cycle, as well as to shape it. The experienced decision maker does not develop his mental model and then passively wait for the outcomes of his assumptions. He can adopt three different strategies, based upon the level of initiative, in order to influence the reliability of the assumptions that formed the model of enemy intent. These three strategies are proactive, predictive, and reactive.[85] A proactive strategy demonstrates the highest level of initiative and attempts to shape the environment so that assumptions created during the critique of the mental model become facts. In the previous example, the planner's mental model is based on the idea that the enemy will attack south; if he follows a proactive strategy as part of his friendly mental model, then he takes proactive measures to ensure that the enemy attacks in that direction. This may include deception that portrays the friendly strength in the north or deep attacks to destroy critical bridges that will force the enemy to go south.

The next level of initiative is the predictive strategy. Within this strategy, the planner does not try to force the enemy to conform to his mental model, but develops a plan based upon the planner's interpretation of the enemy commander's intent. If the planner employs this strategy, once he fully develops his mental model of enemy intent, he then develops plans to fight this specific enemy course of action. In the scenario, the

[84] Marvin S. Cohen, J.T. Freeman, and Steve Wolf, "Metarecognition in time-stressed decision making: Recognizing, Critiquing, and Correcting," Internet, http://www.cog-tech.com/Publications/PubsCT_Theory.htm, accessed 8 April 2002.

[85] Ibid. *Volume I*, 24-25.

planner concluded that the enemy would attack in the south; therefore, his plan becomes focused on defeating this enemy strategy.

What if the enemy attacks in the north? This is where the third strategy is employed—the reactive strategy. This strategy exhibits the least amount of initiative. It mitigates the risks of unanticipated enemy decisions or actions. A reactive strategy is primarily concerned with contingency planning. The development of alternate plans allows the decision maker to quickly react to unexpected events or actions by the enemy commander. While Cohen's research demonstrated that experienced decision makers tend to focus heavily on proactive and predictive strategies, and that novices tend to develop more reactive strategies, each strategy is mutually supporting of the other.[86] "Proactive tactics are utilized to increase the chance that predictive assumptions will turn out to be true," while reactive tactics try to anticipate the unexpected.[87]

THE CRYSTAL BALL TECHNIQUE

In order to discover hidden assumptions within the mental model and to explain conflicting data, Cohen has developed a devil's advocate strategy known as the crystal ball technique.[88] Once a planner or the commander has developed his mental model, incorporating both friendly and enemy actions, he determines the critical events or actions that must occur to ensure the success of the plan. Then the concept of the crystal ball is introduced into the process. By metaphorically "gazing into a crystal ball," the planner assumes that the critical event or action failed to achieve the results needed for the success of the plan. The challenge then becomes explaining why the event or action failed. For example, the commander has identified that enemy force will cross a river at point X. Based upon this mental model of where the enemy will cross, the

[86] Ibid., 25..
[87] Ibid., *Volume II,* 40.
[88] Ibid., 35.

commander's staff has developed a COA that is dependant on the enemy crossing at that particular point. To determine the hidden assumptions embedded within the commander's mental model, the staff engages in critical thinking by approaching the problem as if they already knew the enemy had defeated the COA. If the principal reason for failure was that the enemy did not cross at point X, the staff generate assumptions to explain this incongruity from the mental model and subjectively test each one for reliability. The following are sample explanations that might explain why the enemy failed to cross at point X: the enemy has more advanced engineering equipment that allowed him to cross at different sites; there are other crossing sites that were overlooked during the initial reconnaissance; the enemy has different objectives from our mental model of his intent; and the enemy force is large enough to accept casualties by crossing at a other than optimum site. Eventually, as the decision maker tests the reliability of each assumption, some will be discarded because they fail the test, others may generate additional intelligence collection requirements to determine their validity, and others may require the development of a branch.[89] The result is that the decision maker is equipped with a more complete mental model, a more complete course of action, a more refined collection plan, and a complete set of contingency plans.

The same methodology for discovering hidden assumptions also applies to handling conflict. The danger of conflicting information is that the decision maker may either disregard or "wish away" the conflict, or it may have the opposite effect and unnecessarily undermine his confidence in his original mental model.[90] The crystal ball technique forces the planner to confront alternate realities and then determine the plausibility of each reality. The result is that he understands possible weaknesses in his

[89] Cohen, Freeman, and Thompson, *Training Naturalistic Decision Making*, 263-264. This example of the crystal ball technique is drawn from research involving 34 Army officers noted earlier in the monograph.

[90] Ibid., 264.

original model, and the "explanations may also point to ways that the [model] can be tested."[91] For example, a division planner has formulated a mental model of enemy intent that the enemy is planning their main attack in the south. He then receives information that the enemy has destroyed critical bridges that would support a southern attack. The planner and his staff then use the crystal ball technique and assume that the enemy will still attack in the south, even though the bridges to support that attack have been destroyed. The planning staff then has to establish why the enemy would still attack in the south without the bridges. Following are possible explanations: the bridge was destroyed to impede a counterattack, the destruction was a mistake, this is part of the enemy deception plan, and the enemy has the necessary bridging equipment to ford the river and still attack in the south.[92] The planner subjectively judges additional conditions or assumptions on their reliability. He will dismiss some of these new assumptions out of hand, others will generate additional collection requirements, and others may cause a modification in the plan. The process of justifying the original model in light of changing conditions increases confidence in the original model or provides the reasoning to modify the original model.

This methodology of critiquing mental models, incorporating initiative to shape, predict, or react to enemy decisions, and using the crystal ball technique to discover hidden assumptions to explain conflicting data are all elements of Cohen's R/M Theory.[93] Cohen's model of critical thinking makes pattern recognition theory a problem-solving strategy as opposed to only being a method to make quick decisions during combat.[94] The concluding chapter demonstrates how R/M Theory facilitates anticipation, flexibility, and visualization and proposes a model to replace the doctrinal 8-

[91] Ibid., 265.
[92] Ibid.
[93] Cohen, et al., *Training Critical Thinking for the Battlefield, Vol. I,* 31-41.
[94] Ibid., 10-17.

step war game that leverages the benefits of critical thinking in an environment of uncertainty.

CHAPTER FIVE

BUILDING TACTICAL WAR GAMING AROUND R/M THEORY

The expert decision maker is a critical thinker. He uses his knowledge, intuition, and experience to develop mental models about the enemy and his own forces. The expert decision maker, however, does not stop at mental model development. He uses critical thinking to reveal gaps and conflicts in information, and hidden assumptions in the mental model, to better understand how the enemy and his own forces will fight. With this knowledge, the decision maker reduces the effects of uncertainty by anticipating enemy decisions and seeking information to confirm his assumptions, and manages uncertainty by developing alternative plans to counter unexpected events. The 8-step war game model inadequately deals with uncertainty because its primary role is to provide inputs and refined COA statements and sketches for COA Comparison. The planner's dilemma is to war game multiple COAs, a time-consuming process, in a time-constrained environment. Other planning and decision making tools that are focused at reducing uncertainty, branches, sequels, DSTs, and DSMs, are often not fully developed because of a lack of time. The commander is not effectively managing uncertainty even if he modifies the number of COAs that are war-gamed. This results in a plan that assumes away the many options available to the enemy commander and is just as inflexible as plans that attempt to limit the enemy to two COAs, the most probable and the most dangerous.

The competitive nature of the action-reaction-counteraction sequence is another obstacle to critical thinking. The danger that planners will become personally tied to their mental model of the friendly or enemy plan routinely becomes reality. Instead of finding weaknesses and strengths in their model, the goal then becomes defending the COA at all costs in order to win the war game. Doctrine cautions against this scenario, but the

competitive nature of the iterative process that drives the 8-step war game model facilitates its occurrence instead of discouraging it.

Two major modifications to the MDMP are needed to make it a better tool to manage uncertainty (see Figure 2). The first change places additional emphasis on COA Development by creating a step, immediately following Mission Analysis, focused on developing a complete enemy COA with assumptions, branches and sequels. Using the outputs from this new step, Enemy COA Development (ECOA Development), the planning staff then uses the current step of COA Development to develop the friendly COA. The only difference to the current model of COA Development is the inclusion of a step that critically examines the friendly COA in order to develop a list of assumptions to drive the next step in this modified MDMP, Contingency Planning. This second major change to the MDMP replaces COA Analysis, COA Comparison, and COA Approval. Contingency Planning addresses the assumptions, conflicts, and gaps in information created or identified during ECOA and COA Development by creating a comprehensive list of branches and sequels. The final product is a synthesis of analysis and critical thinking that builds upon the commander's intuitive process by creating shared visualization between the commander and staff and incorporating the concepts of anticipation and flexibility. Both of these changes are explored later in this chapter.

Both ECOA and COA Development draw their strength from R/M Theory; linking pattern recognition to critical thinking in order to make intuitive decision making a problem-solving strategy. The tenets of R/M Theory are codified in the acronym I.D.E.A.S.:

> *IDENTIFY* gaps in the mental model that are likely to have an impact on purposes. Fill gaps with new information if possible, or even assumptions, if necessary.
>
> *DECONFLICT* to resolve significant conflicts between sources, lines of reasoning, or purposes. Resolve the conflicts with new information if possible, or with assumptions if necessary.

> *EVALUATE* significant assumptions in your situation understanding or plan. If there is more than one interpretation of the situation, and/or more than one plan, which set of assumptions is most plausible?
>
> *ACT* to correct any weaknesses in the situation model or plan that you accept.
>
> *STOP* critical thinking when the cost of time is greater than the potential benefit.[95]

This process takes the initial mental model of the enemy commander's intent and then uses the I.D.E.A.S. framework to develop a more complex model. This complex mental model translates into a fully developed enemy COA that highlights options available to the enemy commander, key decisions that the enemy commander has to make, and critical enemy capabilities and

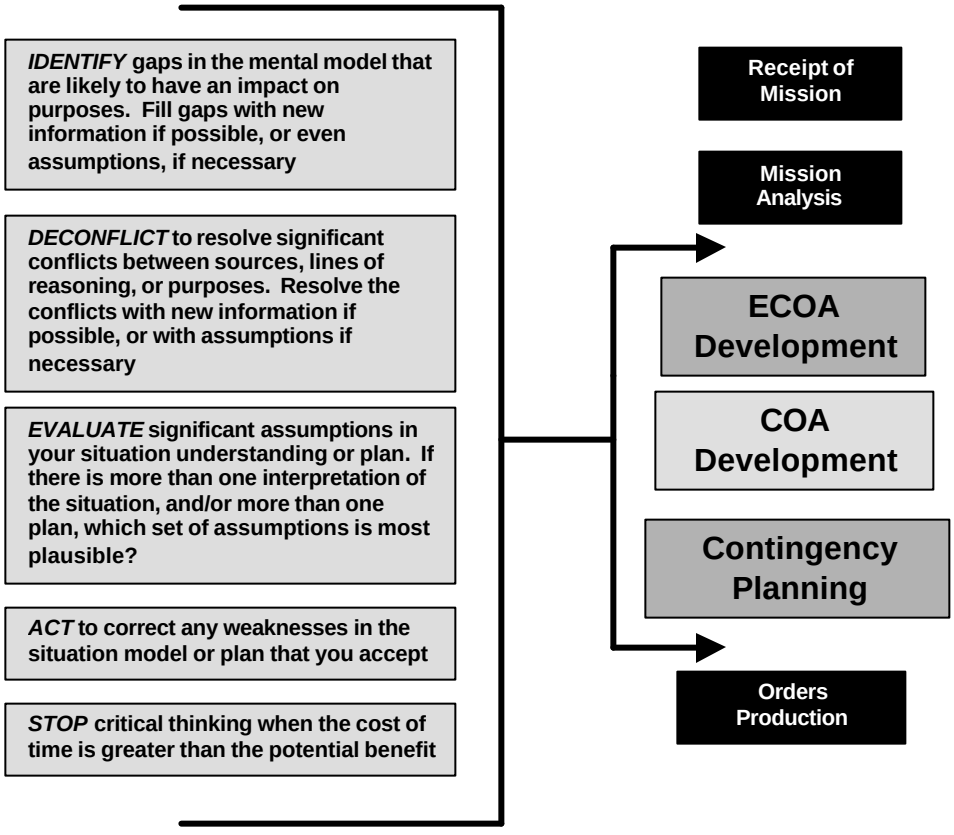

FIGURE 2. PROPOSED MODIFICATIONS TO THE MDMP

vulnerabilities. By using the crystal ball technique, the planner develops a list of assumptions about the enemy that serve as possible enemy branches and sequels. The

identical process is applied against the friendly COA. The planner is now equipped with a list of enemy and friendly assumptions that have been evaluated for plausibility. These assumptions allow the planner to *act* to correct deficiencies through contingency planning. This emphasis on *acting*, or contingency planning, is key to managing uncertainty.

The first prerequisite step to make the tactical war game a bridge to critical thinking is to change the way enemy courses of action are developed. In the time-constrained environment of tactical planning, considering multiple enemy COAs prevents a close examination of the reasons and assumptions that underlie the enemy COA. The result is that the planner develops friendly COAs against enemy ones that do not consider all of the enemy commander's options and possible decisions. For example, the event template, the graphical representation of the enemy commander's options, is often not completed until the war game, after friendly COAs have been developed. Rejecting the paradigm that multiple enemy COAs reduce uncertainty on the battlefield, a new step, ECOA Development, subjects the planner's mental model of enemy commander's intent, which eventually becomes the enemy COA, to a critical examination of gaps and conflicts and a critical review of assumptions in order to provide the framework for the event template. This places the event template into its proper context within the decision making process; a tool for creating friendly COAs instead of solely being used to drive intelligence collection. At the end of ECOA development, the planner is not only equipped with an event template, but also has a list of assumptions vetted for reliability that guards against the uncertainties of war. Each assumption is a marker to apply intelligence collection assets against, and, depending upon the criticality of the assumption, can become a priority intelligence requirement (PIR). Through PIRs,

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[95] Ibid., *Volume II*, 32.

the commander expresses his vision of where he *anticipates* critical points on the battlefield. This step of fully developing the enemy course of action occurs after mission analysis and before development of friendly courses of action. While the G2/S2 retains primary staff responsibility for leading this step, the entire staff is included. Each staff member brings expertise in a particular battlefield function to deduce options available to the enemy commander. It is important that this step not occur simultaneous with friendly COA development. The planning staff's focus should be on using the Crystal Ball Technique to discover gaps and conflicts in the enemy COA and testing enemy assumptions for reliability. In effect, the Crystal Ball Technique replaces Step 8 in the current war game model. Instead of a competitive exercise between the G2 and S2, the Crystal Ball Technique avoids groupthink by forcing the planner to assume that his or her COA is wrong and to develop reasons to explain the failure. The outputs of this step are a fully developed enemy course of action with decision points, a complete event template, recommended PIR, and a list of enemy assumptions that will help drive contingency planning in subsequent steps of the MDMP.

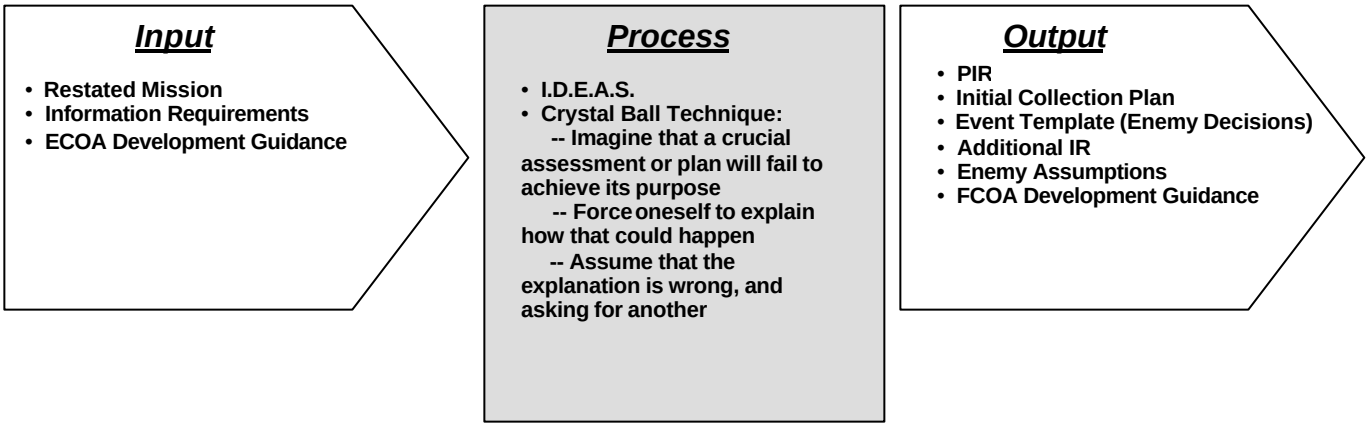

FIGURE 3. ECOA DEVELOPMENT

Friendly COA Development uses the same process. Again, like ECOA development, the intent is not to develop multiple friendly courses of action to deal with

uncertainty. With a fully developed enemy course of action, the staff should recognize and design one COA that attacks critical enemy vulnerabilities and exploits potential opportunities. Even though multiple enemy or friendly COAs are not developed, the focus on assumptions reduces uncertainty because it forces the planner to consider the options available to the enemy as well as options available to the friendly commander. The same rigor that was applied to enemy COA development is applied to this additional step in COA development. Instead of diluting the expertise of the staff into several COA teams, the entire staff pools their expertise together to use the Crystal Ball Technique to discover gaps, conflicts, and hidden assumptions in the single friendly COA. The outputs of this step are a fully developed friendly course of action, an initial decision support template (DST), an initial decision support matrix (DSM), recommended friendly force information requirements (FFIR), and friendly assumptions. In producing these products, there are inherent linkages between enemy COA development and friendly COA development. The completed event template feeds into the development of the DST and the DSM. The PIRs identified during the enemy COA development step translate into possible opportunities for the commander to exploit through his friendly COA. The status of the friendly assets that exploit that opportunity are friendly force information requirements (FFIR). Assumptions produced during friendly COA development are linked with enemy assumptions to drive the next step in this modified MDMP, Contingency Planning. The final step in COA development is the synchronization of the friendly COA. Synchronization is a valuable tool that is carried over from the current model of war gaming. The resulting synchronization matrix accounts for the enemy COA to provide information needed to drive the targeting process and to complete the operations order.

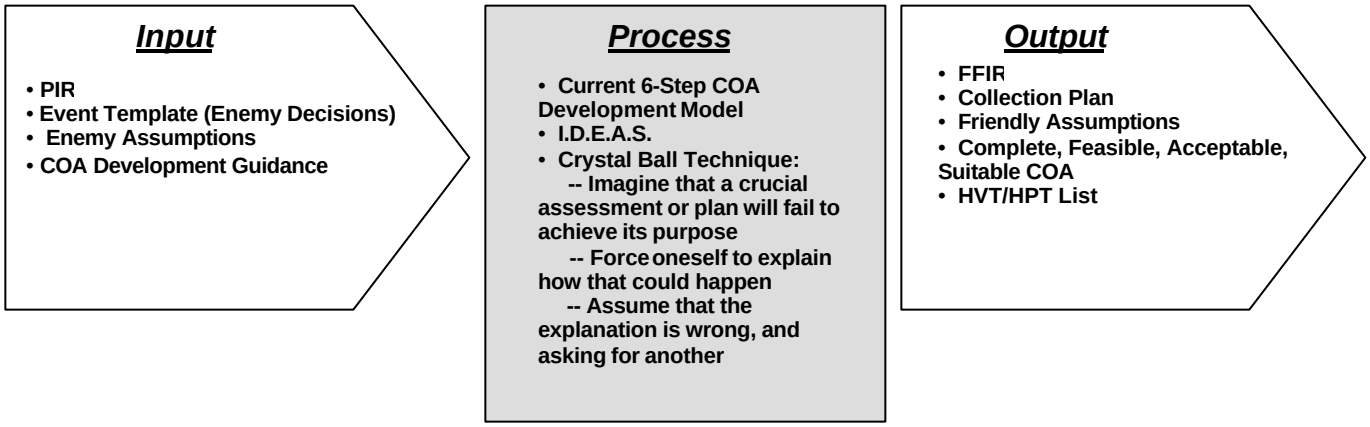

FIGURE 4. MODIFICATIONS TO COA DEVELOPMENT

Instead of being an afterthought during the war game process, a step focused exclusively on contingency planning elevates the development of branches and sequels to its proper role in the MDMP. While most of the information for writing the operations order comes from COA development, Contingency Planning provides the last input for finalizing the DST. The decision support template is the commander's tool that synthesizes the proposed modifications to the MDMP. ECOA Development integrates time-phased lines, PIR, enemy events, activities, and targets; COA Development incorporates friendly events, activities, scheme of maneuver, FFIR, and control measures; and Contingency Planning develops a list of options in order for the commander to maintain flexibility in the face of uncertainty. Not only does the DST graphically represent the plan's flexibility, but it also becomes a representation of the friendly commander's anticipation, through CCIR and decision points, and visualization.

The revised tactical war game's value as a planning tool is that it drives the planner, or decision maker, to think critically about not only his own plan, but the enemy's plan as well. Critical thinking exposes the gaps and conflicts in information and weak assumptions that form the basis of how the planner views his own forces and options and those of the enemy, and forces him to address those incongruities through contingency planning. The current system, with its emphasis on war-gaming multiple

friendly and enemy COAs, prevents critical thinking for a number of reasons. It is a time-consuming process that at best only superficially addresses both friendly and enemy COA development. Secondly, it assumes that the planner possesses a certain level of situational understanding in order to identify either two or three courses of action available to the enemy. Lastly, it is susceptible to groupthink because of the competitive nature of war gaming. The revisions to the MDMP outlined in this monograph would compel the planner or decision maker to confront and explain his own biases and assumptions about both the enemy and friendly COA, and develop contingencies for variations that are identified from the original COA. This methodology not only facilitates group planning by specifically avoiding groupthink, its emphasis on critical thinking and contingency planning serves as the link between the linear and non-linear aspects of military planning.

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